with the effects of stress on electrolyzing glass kept as nearly as possible at different constant temperatures between 100° and 360°. He finds generally that a solid electrolyte like glass is a better conductor of electricity when in a state of strain or torsion than when free from strain. The influence of temperature in changing the value of the electrolytic effect of stress is not marked; the same pull per unit section does not apparently increase the conductivity of glass more at 350° than at 100°, if indeed it increases it as much.—On the formation of siliceous sinter by the vegetation of thermal springs, by Walter Harvey Weed. These researches on the origin of the deposits of siliceous sinter found in the basins of the Yellowstone National Park make it evident that such deposits are largely formed by the vegetation of the hot spring waters. Waters too poor in silica to form sinter deposits by any other cause may be accompanied by beds of siliceous sinter formed by plant life; the extent and thickness of these deposits establish the importance of this form of life as a geological agent.—Marine shells and fragments of shells in the Till near Boston, by Warren Upham. These fossils, occurring in drift deposits near Boston, are usually regarded as evidence of a marine submergence within the Pleistocene or Quaternary period. But Mr. Upham's observations made last year show that they were transported from the bed of the sea on the north by the ice-sheet in the same manner as the materials of the drift have been carried southwards and often deposited at higher elevations than the localities from which they were brought. Hence these shells afford no proof of the former presence of the sea at the level where they are now found.—A platiniferous nickel ore from Canada, by F. W. Clarke and Charles Catlett. The careful analysis here made of these ores from the mines at Sudbury, Ontario, places beyond all doubt the presence of platinum in appreciable quantities. It probably exists in the ore as sperrylite, though this point has not yet been determined.—Stratigraphic position of the Olenellus fauna in North America and Europe, by Chas. D. Walcott. The general result of these researches is to remove the Olenellus fauna both in the Old and New World from the Middle Cambrian to the base of the whole Cambrian system. The paper, which is not concluded, gives full tables of this fauna, with its areas of geographical distribution east and west of the North Atlantic.—Earthquakes in California, by Edward S. Holden. The statistics of seismic disturbances in this region with incidental remarks are brought down to the end of the year 1888.—Chemical action between solids, by William Hallock. In his recent note on a new method of forming alloys, the author undertook to carry out some additional experiments, the results of which are here given. He infers generally that chemical action may take place wherever the products are liquid or gaseous, even though the reagents are solid, with perhaps the added condition that one or both reagents be soluble in the liquid produced.

Revue d'Anthropologie, troisième série, tome iv., deux^{e}. fasc. (Paris, 1889).—On the colour of the eyes and hair of the Aïnos, by M. Lefèvre. These notes were drawn up at the suggestion of Dr. Colignon, while the author was acting as Professor at the Military College of Japan. The principal point commended to his notice was to determine whether there was any foundation for the statement, made by various travellers, that many of the Aïnos present the anomalous condition, that while the hair of the head is red, the beard, and the hair with which various parts of their bodies are profusely covered, are deep black, the skin being sallow, and the eyes light. This coloration is completely at variance with all known physiological relations, and it is obvious from the author's observations that the statement must have arisen from a misconception, due, perhaps, in part to the practice pursued by the Aïnos of colouring their heads a bright red, and tattooing the lips in circular rings of black and blue. The interest of racial coloration is considerable when judged from an ethnological point of view, and special importance attaches to the subject in regard to the Aïnos, who, although undoubtedly a white race, have undergone various modifications in accordance with the different parts of the empire in which they were settled. Thus, while in some districts the people have been forced to adopt the dress and habits of the Japanese, in the neighbourhood of Sapporo, the capital of the Island of Yesso, they have hitherto been enabled to retain their old customs, and keep themselves far more free than elsewhere from intermixture with the Japanese. It is, therefore, the more worthy of notice that in this district no blonde or blue-eyed Aïnos are to be met with, while the people generally have absolutely black hair. It would, in fact, appear that the hair of the normal Aïnos is of a jay-like blackness, coarse and stiff, but bright and lustrous, although in the case of a few of those who have long occupied the sea-coast, the hair is of a dark brown, presenting almost the same softness as that of Europeans. In no section of the people is there the slightest evidence of any anomalous colouring of the hair, eyes, and complexion. M. Lefèvre considers that the stature of the Aïnos is somewhat higher than that of the normal Japanese, while their cranial index, which is found to range from the extremes of dolichocephalism to that of brachycephalism, would seem to give very strong weight to the assumption that these people are not a pure race, and that they differ in accordance with the extent to which Mongolian or other ethnic elements have modified their primitive character.—On the writings and opinions of Samuel Zarza, by M. Salomon Reinach. Considerable interest was excited by a statement made in 1877 by Dr. Topinard, in one of his lectures, afterwards published in the *Gazette Médicale*, according to which a Jew, named Samuel Zarza, was burnt alive in 1450, for having maintained the antiquity of man. This statement excited much attention, and M. Cartailhac, who doubted its accuracy, appealed to his *confrères* for information in regard to the documents from which M. Topinard had quoted. This appeal remained unanswered until the question was lately taken up by M. Reinach, who associated with himself in the necessary investigations a learned Russian Jew, M. Salomon Fuchs. To the latter we are indebted for a commentary on the numerous works of Zarza, surnamed Ben S'né, which, according to his own report, were undertaken in the hope of reviving among his co-religionists in Spain their interest in philosophical and theological inquiries, which had nearly died out amid the miseries they had endured during the civil wars between Peter the Cruel and his brother, Henry II. M. Fuchs has failed to find in these works any opinion expressed concerning the antiquity of man, although the writer appears to have adhered to the belief of the eternity of the world. It is, moreover, obvious from his reference to his age when he completed his second work, entitled "Mikhalal-Yophi," *i.e.* "Perfection of Beauty," in 1369, that he could not have survived until 1450, which is given by the commentators of the seventeenth century, from whom Dr. Topinard borrowed his references, as the date of his presumed martyrdom. While M. Fuchs thus supplies another proof of the inaccuracy of many of the earlier commentators, he at the same time shows by his summary of Zarza's writings that Hebraists might throw interesting light on the early dawn of scientific inquiry by a careful study of the numerous still unprinted remains of Zarza, and of his Spanish co-religionists, who undoubtedly exercised an active influence on the progress of learning in the Middle Ages.—On the belief in familiar household spirits and other forms of superstition, by Dr. Berenger-Feraud. The interest of this paper to the student of folklore depends upon the writer's detailed narratives of the local superstitions still prevailing, or only recently exploded, in the rural districts of France; his elaborate exposition of the superstitions of other countries has little value for the English reader.—On questions regarding the Aryans, by M. de Lapouge. The author believes that, at the present stage of our knowledge, we are justified in assuming that in the ancient Aryans we have a blonde dolichocephalic race, whose cradle was in the north-west of Europe as it existed in the second half of the Quaternary age.—On the steatopygia of the Hottentots in the Garden of Acclimatization by M. Topinard.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 7.—"On the Wave-Length of the Principal Line in the Spectrum of the Aurora." By William Huggins, D.C.L., LL.D., F.R.S.

I think it is very desirable that I should put on record some observations of the spectrum of the aurora which I made in the year 1874, but which, up to the present time, have remained unpublished. These observations were made with a powerful spectroscope, and under conditions which enabled me to determine the wave-length of the principal line within narrow limits of error. The spectroscope was made by Sir Howard Grubb, on the automatic principle of his father, Mr. Thomas Grubb. It is furnished with two "Grubb" compound prisms; each has 5 square inches of base, and gives nearly twice the dispersion of a single prism of 60°—namely, about 9° 6′ from A to H.

The observations were made on February 4, 1874. There was a brilliant aurora, showing a whitish light; a direct-vision spectroscope resolved this light into a brilliant line in the yellow and a faint continuous spectrum.

The "Grubb" spectroscope was directed from the window of the Observatory upon the brightest part of the aurora. In the first instance, an estimation by eye was made of the position of the bright line by comparing it in the instrument with the spectrum of a spirit-lamp. The bright line was seen to fall on the more refrangible side of the line for which Watts gives the wave-length 5582 (*Phil. Mag.*, vol. xli., 1871, p. 14), Ångström and Thalén 5583 ("Spectres des Métalloïdes," *Nov. Act. Soc. Sci. Upsal.*, vol. ix., 1875, p. 29), by from one-fifth to one-fourth of the distance of this line from the beginning of the band. If we take one-fourth, we have λ 5569·6; one-fifth gives λ 5572·3. The mean of these values gives for the

Aurora line λ 5570·9 . . . . (1)

The cross-wires of the spectroscope were then brought upon the line, and the reading 3476 showed the line to fall about midway between two strong lines in the spectrum of tin, λ 5564 and λ 5587 respectively, according to my measures ("Spectra of the Chemical Elements," Phil. Trans., 1864, p. 139). The position of the cross was then compared directly with those lines in the spectrum of an induction spark taken between electrodes of tin. The further details of this comparison are not given in my note-book, but the result only, which placed the

Aurora line at λ 5571 . . . . (2)

Consulting my map of the chemical elements, I found that there was a line of tellurium very near this place—namely, at λ 5575; I therefore brought the spark from tellurium before the slit, when the cross appeared on the more refrangible side of the tellurium line. The measure of the distance of the cross from this line came out equal to λ 0003. The place given in my paper for this line of tellurium is 5575. Thalén gives for the same line 5574·1 (Brit. Assoc. Rep., 1885, p. 292). If we take the mean of these values and deduct 0003, we get for

The line of the aurora λ 5571·5 . . . . . (3)

There are strong lines of iron very near this position in the spectrum, and I made use of these also for a further determination of the place of the aurora line. The cross, after having been placed upon the line of the aurora, was confronted with these lines in the spectrum of iron.

The condensed account in my note-book does not give further particulars of this comparison, but states only that the place of the

Aurora line came out λ 5571·5 . . . . . (4)

Summing up these determinations we have—

(1) Eye-estimation	λ 5570·9
(2) From tin	5571·0
(3) From tellurium	5571·5
(4) From iron	5571·5

From these values I think that we are justified in taking for the aurora line, as a position very near the truth,

λ 5571 ± 0·5 . . . . (5)

Among the numerous determinations of other observers, those of Prof. H. C. Vogel in 1872 (*Lepzig Math. Phys. Berichte*, vol. xxii. p. 285) seem to me to have great weight. A direct-vision spectroscope with a set of five prisms was used. The reduction of the readings of the micrometer into wave-lengths was based upon the repeated measures of 100 lines of the solar spectrum.

The screw had been thoroughly examined. After each observation of the aurora line, readings were taken of the lines of sodium or of hydrogen. The observations extended over four nights. On three nights four separate readings were obtained; on the fourth night two only. Vogel gives as the mean result of the fourteen observations—

Aurora line λ 5571·3 ± 0·92 . . . . . (6)

The recent observations on the spectrum of the aurora by Gyllenskiöld, at Cap Thordsen, in 1882, deserve special mention.[1] With a Hoffmann spectroscope, furnished with a scale, he obtained at Cap Thordsen in 1882 a mean result of λ 5568 ± 1·6; later, in 1884, at Upsala, with a Wrede spectroscope furnished with a micrometer screw, a mean value for the aurora line, λ 5569 ± 6·2.[2] Gyllenskiöld discusses in detail nearly all the recorded observations of the spectrum of the aurora from 1867 to 1882, and then brings them together in a table, with such probable errors as the original statements of the observers enabled him to assign to them.

Gyllenskiöld then calculates by the method of least squares the mean value of all the determinations, and finds the following result:—[3]

Mean value of the 23 observations, λ 5570·0 ± 0·88 . . (7)

The recent measures by C. C. Krafft,[4] depart largely from Gyllenskiöld's mean value. Krafft found on

1882 November 2	λ 5595
,, ,, 11	5586

and measures with the same instrument made by Schroeter, on November 17, gave λ 5587.

Now, though Ångström's original value, λ 5567, may not be quite accurate, his observation fixed a limit towards the red beyond which the aurora line cannot lie. Ångström says: "Sa lumière était presque monochromatique, et consistait d'une seule raie brillante située à gauche" (on the more refrangible side) "du groupe connu des raies du calcium" ("Spectre Solaire," Upsal, 1868, p. 42). The position of the most refrangible line of this calcium group is accurately known; according to (Brit. Assoc. Rep. 1884, p. 372)

Kirchhoff	λ 5580·9
Thalén	5580·9
Huggins	5581·0

It is certain therefore, from Ångström's first observation in 1867, alone that the aurora line lies well on the more refrangible side of wave-length 5580. This limit towards the red was confirmed afterwards by Ångström himself; he says later that the yellow line falls almost midway between the second and third line of the shaded carbon group (NATURE, vol. x. p. 211). The positions of these lines of comparison are, according to Ångström and Thalén, λ 5538 and λ 5583 (*Acta Upsal.*, vol. ix. 1875, p. 29).

It follows that Krafft's values, λ 5586, λ 5587, and λ 5595, must be from some cause inaccurate. A possible explanation may be found in the small number of solar lines employed by Krafft for the reduction of the measures into wave-lengths. The curve was drawn through the six Fraunhofer lines, B, C, *a*, D, E, and *b*. There was no control for the curve between D and E, and a very small deviation of the curve from its true position here would be sufficient to account for the position of less refrangibility of from λ 0016 to λ 0024, which his measures give for the aurora line.

It should be stated that Krafft expresses regret that more attention could not be given to the spectroscopic observations. He says:—"Leider gestatteten die obligatorischen Beobachtungen nicht, den spectroscopischen Untersuchungen die gehörige Aufmerksamkeit angedeihen zu lassen. . . . Ich glaubte ausserdem diese Messungen um so mehr auslassen zu können, als der Platz der gewöhnlichen Nordlichtlinie oft und sehr genau bestimmt ist."

To sum up, we have the following values for the principal line of the aurora:—

(6) 1872, Vogel	λ 5571·3 ± 0·92
(5) 1874, Huggins	5571·0 ± 0·5
(7) Gyllenskiöld's mean of twenty-three observers from 1867 to 1884 . . .	5570·0 ± 0·88

These values agree closely, and fix within very narrow limits, the position in the spectrum where we have to seek the chemical origin of the line.

Gyllenskiöld, from his observations of the changes which occur in the spectrum of the aurora, comes to the conclusion that "le spectre de l'aurore boréale résulte de la superposition de plusieurs spectres différents," and that "la raie principale forme un de ces spectres élémentaires ; elle apparait très souvent seule." A similar view was taken many years ago by Ångström (NATURE, vol. x. p. 210) and by Vogel (*Leipzig Math. Phys. Berichte*, vol. xxiii. p. 298).

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[1] "Observations faites au Cap Thordsen, Spitzberg, par l'Expédition Suédoise," vol. ii. part 1, "Aurores Boréales," par Carlheim-Gyllenskiöld (Stockholm, 1886).

[2] *Ibid.* p. 166.

[3] *Ibid.* p. 169.

[4] "Beobachtungs-Ergebnisse der Norwegischen Polarstation," &c. A. S. Steen (Christiania, 1888).

[After consideration, I think that I ought to point out that Mr. Lockyer's recent statement (Roy. Soc. Proc., vol. xlv., 1889, p. 234), that "the characteristic line of the aurora is the remnant of the brightest manganese fluting at 558," is clearly inadmissible, considering the evidence we have of the position of this line.

In support of this statement Mr. Lockyer says :—"Ångström gave the wave-length of the line as 5567, and since then many observers have given the same wave-length for it, but probably without making independent determinations. Piazzi Smyth, however, gives it as 558, which agrees exactly with the bright edge of the manganese fluting. R. H. Proctor also gives the line as a little less refrangible than Ångström's determination. He says: 'My own measures give me a wave-length very slightly greater than those of Winlock and Ångström' (NATURE, vol. iii. p. 468)."

By reference to Gyllenskiöld's table it will be seen that the probable errors of the determinations by Piazzi Smyth and Proctor, 5579 ± 9·5 and 5595 ± 25·0 respectively,[1] are too large to entitle these measures to special weight.

Mr. Lockyer says, further :—"Gyllenskiöld's measures with the Wrede spectroscope also give 5580 as the wave-length of the characteristic line. I feel justified, therefore, in disregarding the difference between the wave-length of the edge of the manganese fluting and the generally accepted wave-length of the aurora line."

Gyllenskiöld's single measure of 5580, on which Mr. Lockyer relies, differs widely from the values which Gyllenskiöld himself assigns to this line—namely, from observations at Cape Thordsen in 1882, λ 5568 ± 1·6, and from observations at Upsala in 1884, with the Wrede spectroscope, λ 5569 ± 6·2.

Speaking of Krafft's observations, Mr. Lockyer says (Roy. Soc. Proc., vol. xlv., 1889, p. 241):—"The wave-lengths obtained for the aurora line were 5595, 5586, and 5587. Unlike most observations, these place the aurora line on the less refrangible side of the manganese fluting. Hence, we have an additional reason for neglecting the difference between the wave-length of the brightest edge of the manganese fluting, and the commonly accepted wave-length of the aurora line, as given by Ångström. . . . These observations are the latest which have been published, and were obviously made with a full knowledge of all previous work, so that their importance must be strongly insisted upon."

I have already pointed out that Krafft's measures were not made under circumstances which assured to them a high degree of accuracy : and Krafft's own words, which I have quoted, disclaim expressly any special attempt on his part to redetermine the position of the principal line with a higher degree of accuracy than the observers who preceded him.—March 4.]

May 2.—"The Accurate Determination of Carbonic Acid and Moisture in Air." By J. S. Haldane, M.A., M.B., and M. S. Pembrey (Physiological Laboratory, Oxford). Communicated by Prof. J. Burdon Sanderson, F.R.S.

The authors show that, in spite of the efforts which have been made in recent years to improve the method of Pettenkofer for determining CO_2 in free air, the results obtained by different observers still seriously disagree. They also point out the serious defect in the ordinary "chemical" method of determining moisture in air, that in spite of its superior accuracy it only gives accurate results over a long period, while the proportion of moisture in the air is constantly changing.

A method is then described for determining simultaneously the CO_2 and moisture in air. The method is gravimetric. The CO_2 is estimated by the increase in weight of an apparatus of simple construction containing soda lime, through which a known volume of the air has been passed. The moisture is similarly estimated by means of an apparatus containing pumice soaked in sulphuric acid. The increased accuracy and convenience of the method depend on the facts: (1) that a very rapid current of air may be passed through the apparatus without fear of non-absorption of either CO_2 or moisture ; (2) that by the method of counterpoising with a dummy apparatus during weighing the "errors of weighing" are reduced to about a tenth of what they would otherwise be. It is shown that with these two improvements the method for moisture gives in a period of experiment of one minute a result equal in accuracy to that obtained with the ordinary method in a period of two hours.

Using their own method for CO_2 as a standard, the authors have also tested the Pettenkofer method. They find that the latter method usually gives results for free air about a fifth too high, but that the error is less in proportion with air containing larger amounts of CO_2.

As a number of sets of absorption apparatus can easily be carried about, the new method is well suited for experiments in hygiene, and especially for cases in which a series of experiments require to be made in rapid succession. Both kinds of absorption apparatus last over a large number of experiments without refilling.

Physical Society, April 13.—Prof. Reinold, President, in the chair.—Mr. Shelford Bidwell, F.R.S., showed a lecture experiment illustrating the effect of heat on the magnetic susceptibility of nickel, and an experiment showing an effect of light on magnetism. In the first experiment a piece of nickel was attached to one side of a copper pendulum bob, which was held out of the vertical by bringing the nickel in contact with a fixed magnet. On placing a spirit-lamp flame below the nickel, the bob was, after a short time, released, and oscillated until the nickel had cooled, when it was again attracted and the operation repeated itself. The second experiment had been recently shown before the Royal Society. One end of an iron bar, which had been magnetized and then demagnetized, was placed near a magnetometer needle. On directing a beam of light on the bar an immediate deflection of the needle resulted, and on cutting off the light the needle promptly returned to near its initial position. The direction of magnetization induced by the light is the same as the previous magnetization, and the bar seems to be in an unstable magnetic state. That the effect is due to light and not heat, the author thinks is rendered probable by the suddenness of the action. The President said he had tried the experiment himself and failed to get any effect, but after seeing the arrangement of apparatus used, he believed his non-success due to the comparatively great distance between his bar and needle. Mr. C. Richardson asked if the results were different for different coloured rays, and Prof. S. P. Thompson inquired whether the magnitude of the effect varied with the intensity of illumination as in selenium, and also if any change was produced by altering the direction of vibration of the incident light. Mr. G. M. Whipple wished to know whether any difference was produced by blackening the bars, and as bearing somewhat on the same subject mentioned an induction magnetometer in which an iron bar used was demagnetized by plunging in hot water. The results obtained were very irregular after the first magnetization, and this may have been due to the instability shown to exist by Mr. Bidwell's experiment. In reply, Mr. Bidwell said red light produces most effect, and blackening the bar makes the action much slower. As regards selenium, the character of the effect is similar, but he believes the causes to be different. Polarized light produces no change. In answer to Prof. Herschel, he said that any part of the bar is sensitive to light, and showed that illuminating both sides of the bar increased the effect.—Mr. G. M. Whipple read a note on the dark flash seen in some lightning photographs. After expressing his dissent from the explanations offered in the report of the Lightning Flash Committee of the Meteorological Society and Prof. Stokes respecting ribbon lightning and dark flashes, the author described some experiments he had made on the subject. Ribbon lightning he conceived to be an effect produced by taking the photographs through windows, and to test this, lines on a blackboard were photographed, (1) direct ; (2) through good plate-glass placed obliquely ; and (3) through window-glass, the result being that the double, triple, and ribbon flashes were closely imitated. As regards "dark flashes," the author believes the appearance due to the prints being taken in oblique light, and to be produced by successive reflection from the reduced silver forming the dark line on the negative and the upper surface of the glass of the negative. Prof. Perry suggested that this might be easily proved by examining a negative, the prints from which show the dark flash. Mr. Baily pointed out that, if the explanation given were correct, the dark line should be parallel to the bright one, and this he understood was not always the case. Mr. Boys remarked that one dark flash exhibited minute wriggles not seen in the bright one, and Mr. C. V. Burton thought these might be due to irregularities in the upper surface of the negative. Dr. Gladstone said he was not satisfied with Prof. Stokes's nitrous oxide explanation, but thought the phenomenon may be due to some kind of reversion. He also mentioned that a negative might probably be obtained from Mr. Shephard, of Westbourne Grove. As regards multiple flashes, Mr. Boys said he had often seen seven or eight flashes traverse the same path in rapid succession. On the motion of the President, the discussion was adjourned until the next meeting, when Mr. Whipple hopes to exhibit the negative referred to, together with photographs of his experimental dark flashes.—On quartz as an insulator, by Mr. C. V. Boys, F.R.S. In making quartz fibres the author observed that the ends of fibres broken during the shooting process coiled up into screws, and projected themselves against anything brought in their vicinity. After a short time they released themselves and sprang back to their original position. This could be repeated indefinitely, and the only explanation he could think of was that the fibre was electrified. If so, then to exhibit such phenomena the insulating qualities of quartz must be very great, and experiments were shown to demonstrate this deduction. A small pair of charged gold leaves were suspended from a short quartz rod in a moistened atmosphere, and the deflection fell one-quarter the original amount in about five hours. A clean glass rod under the same conditions would discharge the leaves in a few seconds. Dipping the quartz into water did not seem to diminish its insulating properties, and ordinary chemicals produced no permanent prejudicial effect. The author considers that quartz will be very useful in electrostatic apparatus, for the troublesome sulphuric acid may be dispensed with.—On a refraction goniometer, by Mr. A. P. Trotter. The goniometer, which was designed when determining the figure of a refracting surface to effect a special distribution of light, is practically a movable four-bar linkwork, representing the figure given in Deschanel (p. 924); two of the bars are parallel to the incident and emergent rays, and the other two normals to the faces of the prism. By its means the angle of a prism to produce a given deviation, when the index of refraction and angle of incidence are known, can be readily found. A series of curves expressing the relation between incidence and deviation for prisms of various angles were shown, and the same curves show the minimum deviation and limiting angle for prisms of all angles represented. The author thinks the instrument will be useful in physical laboratories for adjusting optical apparatus and for the calculation of lighthouse and other polarized lenses, Fresnel prisms, &c. Prof. Herschel said he found a wooden model illustrating the relations between the angles of incidence and refraction very useful in teaching; and Mr. Blakesley sketched an arrangement of links and cords devised for the same purpose. Mr. Boys considered that all such relations were best seen on a slide rule.—A note on apparatus to illustrate crystal forms, by Prof. R. J. Anderson, was read by Prof. Perry. The apparatus is constructed of cords, pulleys, and weights arranged to produce the required figure when in equilibrium. By increasing or decreasing some of the weights the corresponding axes of the crystal forms can be lengthened or shortened, and the passage from one system to another effected. In one arrangement the forces may be divided or united, and the pulleys are carried by rings capable of rotating on different axes. By this apparatus the various conditions are said to be beautifully illustrated, and methods of deriving the oblique from the rectangular systems are shown in photographs which accompany the paper.

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[1] Gyllenskiöld's statement of Proctor's value is based on NATURE, vol. iii. p 347 and p. 68.

Entomological Society, May 1.—Mr. Frederick Du Cane-Godman, F.R.S., Vice-President, in the chair.—Mr. W. L. Distant announced the death of Dr. Signoret, of Paris, one of the Honorary Fellows of the Society.—Dr. Sharp exhibited male and female specimens of *Rhomborhina japonica*, in which the thorax was abnormal; also, a specimen of *Batocera roylei*, which he had kept in a relaxed condition in order to be able to demonstrate the power of stridulation possessed by this species.—Dr. N. Manders exhibited a small collection of Coleoptera, including several remarkable and very interesting species, recently made by him in the Shand States, Burmah.—Mr. C. O. Waterhouse exhibited, for Mr. Frohawk, a series of wings of British butterflies, prepared in accordance with a process (described by Mr. Waterhouse in the Proc. Ent. Soc., 1887, p. xxiii.), by which they were denuded of their scales so as to expose the neuration.—Dr. P. B. Mason exhibited cocoons of a species of spider—*Theridion pallens*, Black.,—from Cannock Chase, distinguished by the presence of large blunt processes on their surface.—Mr. H. Goss exhibited, for Mr. N. F. Dobrée, a number of scales of *Coccidæ*, picked off trees of *Acacia melanoxylon* and *Grevillea robusta*, growing in the Market Square, Natal. These scales had been referred to Mr. J. W. Douglas, who expressed an opinion that they belonged to the family *Brachyscelidæ*, and probably to the genus *Brachyscelis*, Schrader. He said that most of the species lived on *Eucalyptus*.—Captain H. J. Elwes exhibited a long and varied series of specimens of *Terias hecabe*. He remarked that all the specimens which had strongly defined markings were taken in the cold and dry season, and that those which were without, or almost without, markings, were taken in the hot and wet season; further, that he believed that many specimens which had been described as distinct were merely seasonal forms of this variable species. Mr. W. L. Distant, Mr. F. D. Godman, F.R.S., Prof. Meldola, F.R.S., Mr. H. T. Stainton, F.R.S., and Mr. G. Lewis took part in the discussion which ensued.—Mr. H. Burns exhibited, and made remarks on, a number of nests of living ants of the following species, viz. *Formica fusca*, *Lasius alienus*, *L. flavus* *L. niger*, *Myrmica ruginodis*, *M. scabrinodis*, &c. One of the nests contained a queen of *L. flavus*, which had been in the exhibitor's possession since September 1882.—Mr. W. Dannatt exhibited specimens of *Thaumantis howqua*, West., from Shanghai.—Mr. G. C. Bignell communicated a paper entitled "Description of a New Species of British *Ichneumonidæ*."—Mr. A. G. Butler communicated a paper entitled "A Few Words in reply to Mr. Elwes's statements respecting the incorporation of the Zeller Collection with the General Collection of Lepidoptera in the Natural History Museum." Captain Elwes, Mr. Stainton, Mr. Godman, and others, took part in the discussion which ensued.

PARIS.

Academy of Sciences, May 7.—M. Des Cloizeaux, President, in the chair.—On elliptical polarization by vitreous and metallic reflection; extension of the methods of observation to the ultra-violet radiations, by M. A. Cornu. The principles on which Cauchy has established the theory of these two orders of phenomena and the form of the laws controlling them differ so greatly that most physicists regard them as essentially distinct. But these experiments show that this is not the case, and that the same substance may present a continuous transition from one to the other according to the nature of the reflected radiation. It follows that the phenomena presented by transparent substances with metallic sheen (fuchsine, platinocyanides, &c.), far from being exceptional, merely constitute particular forms of the general phenomenon of reflection.—On the origin of bronze, by M. Berthelot. The author has analyzed specimens from a statuette from Tello in Mesopotamia, and from the sceptre of the Egyptian king Pepi I. (sixth dynasty), both dating back to about 4000 B.C., and both consisting of pure copper. From this he argues that, as in the New World, the Stone Age was followed by a Copper Age in the eastern hemisphere, and that the bronze period cannot be more than some fifty or sixty centuries old.—On the thionic series; action of the alkalies, by M. Berthelot. Having already determined the heats of formation of the thionic compounds (*Comptes rendus*, cviii. p. 773), the author here deals with the reciprocal transformations of these compounds under the influence of the alkalies. The pentathionates, tetrathionates, and trithionates are treated in detail, and it is concluded that these as well as other compound substances, such as metaphosphoric and pyrophosphoric acids, hitherto regarded as isolated and exceptional, all come within the same general theories as the organic acids.—Note on an iron meteorite discovered buried in the ground at Haniet-el-Beguel in Algeria, by M. Daubrée. This meteorite, found at a depth of 5 metres, while sinking a well in the Wed Mzab district, appears to be of great age, having fallen probably during the Quaternary epoch. It shows the Widmanstätten figures quite distinctly, and its other characteristics place its extra-terrestrial origin beyond all doubt.—Remarks accompanying the presentation of the third part of the *Bulletin international de la Carte du Ciel*, by M. Mouchez. In these remarks special attention is called to Mr. Isaac Roberts's *pantograveur stellaire*, an ingenious and valuable process, by means of which the photographic impressions of the stars can easily be transferred to metallic plates, and thus preserved from all danger of perishing. The method is simple and economical, and allows of an unlimited number of copies being taken for general use. By this invention all risk is removed of the labours of the International Association for photographing the Heavens being lost to future generations.—Researches on the application of the measurement of rotatory power to the study of the compounds formed by the action of the magnesium and lithium molybdates on the solutions of tartaric acid, by M. D. Gernez. The present series of experiments are analogous to those already described in previous communications, demonstrating the great increase experienced by the rotatory force of certain active compounds when their solutions are placed in contact with various substances without proper action on polarized light. Here M. Gernez studies more particularly the action of the neutral magnesium molybdate on solutions of tartaric acid, and the action of the neutral lithium molybdate on the same solutions. Combining these with the results already obtained, he is now able to formulate the following general conclusion: The simplest combinations which are produced in aqueous solution between tartaric acid and the neutral molybdates and tungstates hitherto studied, and which correspond to a maximum rotatory power, are formed by the union of the acid with the salt molecule for molecule.—On the atomic weight of ruthenium, by M. A. Joly. In a previous communication (*Comptes rendus*, cvii. p. 994) the author announced that the analysis of compounds of nitric oxide with rutheno-chlorides led to a reduction of about two units in the atomic weight of ruthenium (104–103·5) as determined by the latest researches of Claus. He now finds this view confirmed by his own studies, and provisionally fixes the atomic weight of this element at 101·4. In its preliminary transformation into compounds containing nitric oxide the ruthenium was completely freed from osmium, the atomic weight of which, according to Seubert's last determinations, is nearly double (191), and this would explain the considerable reduction in the atomic weight of the ruthenium itself.—On α-oxycinchonine, by MM. E. Jungfleisch and E. Léger. A detailed description is given of the preparation, properties, salts, and various derivatives of this substance, the formula of which is $C_{38}H_{22}N_2O_4$.—On the alcoholic fermentation of the juice of the sugar-cane, by M. V. Marcano. The object of these studies has been to determine the agent of the alcoholic fermentation, as well as the nature of the products accompanying the alcohol yielded by the juice of the sugar-cane.—Action of zinc chloride on isobutylic alcohol in the presence of hydrochloric acid, by MM. H. Malbot and L. Gentil. The points here chiefly studied are the part played by the isobutyl chloride, and the properties of the polybutylenes.—On an artificial silk, by M. de Chardonnet. The author has prepared from a pure cellulose octonitrate a silk-like fabric of great elasticity and softness, more lustrous than the silk of cocoons, and capable of being dyed by the ordinary processes. Specimens will be shown at the Universal Exhibition.—M. Daubrée paid a tribute to the memory of the late M. Lory, Corresponding Member of the Section for Mineralogy, who died at Grenoble on May 3.

BERLIN.

Physical Society, April 5.—Prof. von Helmholtz, President, in the chair.—Prof. Rosenthal, of Erlangen, described his calorimeter and the experiments he had made with it on the heat-production of the animal body. (See report of the Physiological Society in NATURE of April 25, p. 624.) He then showed a small experiment on making flames non-luminous. This result can be obtained either by means of a strong current of air or by considerable cooling. The speaker, however, produced the same effect in the following way. A small gas-flame is made to burn brightly inside a cylindrical chimney; it becomes non-luminous as soon as a platinum crucible is placed on the chimney so as to incompletely close the upper end of the cylinder. Prof. Rosenthal believes that in this case the current of air through the chimney is very considerably slowed, hence the gas issuing from the burner becomes disseminated throughout the whole mass of air, and as a result of this, the temperature being low, it burns without giving any light. Several other explanations of the phenomenon were suggested by the members present at the meeting.—Dr. Fröhlich made a further communication in connection with his older, resultless experiments on the objective demonstration of the vibrations of a telephone-disk, in order to describe his new method by which positive results had been obtained. In his earlier experiments he employed manometric flames, and endeavoured to photograph their movements with the help of a rotating mirror; now, however, he attaches a small mirror to the iron plate of the telephone, and from this the light of an electric lamp is reflected on to a polygonal rotating mirror, from which it falls upon a screen. The vibrations of the plate were thus made visible on the screen, and since each side of the polygonal mirror cast its own image, when the mirror was rotated the curves were seen moving over the screen. The more rapidly the mirror was rotated the slower did the curves move over the screen, and when the rotation was as rapid as the vibration of the plate, the curves became stationary and could thus be exactly observed and drawn. These luminous curves could also be photographed. The speaker had employed this method in a series of researches on certain electrical phenomena which might influence the efficiency of the telephone. Thus the action of alternating currents, of self-induction, of the rise and fall of the current on making and breaking, of the introduction of electro-magnets, and of other conditions, were studied by means of the altered mode of vibration of the telephone plate. The speaker had further obtained a graphic record of the vibrations of the telephone plate when vowels and consonants are sung and spoken into it. Many other problems may, by the above method, be brought nearer to their solution.—Dr. Reichel showed a lecture-experiment with a water-hammer. When the bulb in which the fluid is contained is grasped in the warm hand, the fluid is driven over to the other side by means of the vapour which is then formed. When all the fluid has thus passed over, bubbles of vapour finally make their way through the fluid, and at this moment the hand which is grasping the bulb experiences a distinct sensation of cold.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Illustrations of Zoology: W. R. Smith and J. S. Norwell (Pentland).—South Africa as a Health Resort, 2nd edition: A. Fuller (Whittingham).—A Dictionary of Explosives: Major J. P. Cundill (Mackey, Chatham).—Three Cruises of the *Blake*, 2 vols.; Bulletin of the Museum of Comparative Zoology at Harvard College, in Cambridge, vols. xiv. and xv.: A. Agassiz (Cambridge, Mass.).—Bibliography of Meteorology—Part 1, Temperature: edited by O. L. Fassig (Washington).—Mr. Stranger's Sealed Packet: H. MacColl (Chatto and Windus).—Travels in the Atlas and Southern Morocco: J. Thomson (Philip).—A Treatise on Trigonometry: W. E. Johnson (Macmillan).—Darwinism: A. R. Wallace (Macmillan).—Life of Charles Blacker Vignoles: O. J. Vignoles (Longmans).—Gleanings from Japan: W. G. Dickson (Blackwood).—Celestial Motions, 6th edition: W. T. Lynn (Stanford).—Our Fancy Pigeons, cheap edition: G. Ure (Stock).—Natural Science Examination Papers—Part 1, Inorganic Chemistry: R. E. Steel (Bell).

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